EUROPEAN SCHOOL OF ANTENNAS
ESoA 2014

MM-WAVE ANTENNA DESIGN AND TECHNOLOGIES

5th Edition - 19-23May, 2014

Supported by ESF Research Networking Programme "NEWFOCUS"

Course Summary

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1. Summary

This document presents a report about the Mm-wave Antenna Design and Technologies course that took place in IETR- University of Rennes 1 from the 19th of May to the 23th May 2014. The course was attended by 28 students, Three of which benefitted from New Focus scholarship that covered the inscription.

The course provides the attendees with a large overview on planar antenna applications, physical principles and technology. Non planar structures are also addressed for mm-wave antennas. Emphasis is put on technological aspects (microstrip, microtechnologies, MEMS, metrology…) and specific field of applications (satellite antennas, mobile phones, base stations, car ACC radar…). The structures and parametric studies presented in the course are validated by CAD softwares (HFSS, Ansoft Designer, etc.). The module gives the student a thorough background of mm-wave antennas and arrays than the printed antennas, including lenses, reflectors, leaky-waves, dielectric resonators, dielectric rods, Gaussian Beam Antennas, EBG antennas, etc. The course is accompanied with pattern measurements in mm-wave anechoic chamber and impedance measurements on VNA **(**Vector Network Analyzers).

2. Speakers

The expenses of Professor Lorentz Schmidt, Dr Vincent Laur and Camilla Karnfelt were covered by the support given within the framework of the ESF activity “New Focus”

	Name	University	Country	Hours of Lectures
1.	Prof. Ala Sharaiha	University of Rennes 1	France	2,3
2.	Dr. Camilla Karnfelt	Telecom Brest	France	2,45
3.	Dr. Laurent Dussopt	CEA Leti	France	2,45
4.	Dr. Jean Marie Floch	Institut National des Sciences Appliquées de *Rennes (INSA)*	France	1+6H of Lab
5.	Prof. Kouroch Mahdjoubi	University of Rennes 1	France	2
6.	Dr. Laurent Le Coq	University of Rennes 1	France	1,3+6H of Lab
7.	Prof. Lorentz Schmidt	University of Erlangun Nürnberg	Germany	2,45
8.	Prof. Mohammed Himdi	University of Rennes 1	France	2,3
9.	Dr. Olivier Lafond	University of Rennes 1	France	2
10.	Prof. Raphael Gillard	INSA	France	2,45
11.	Prof. Ronan Sauleau	University of Rennes 1	France	2,45
12.	Dr. Sylvain Collardey	University of Rennes 1	France	6H of Lab
13.	Dr. Vincent Laur	Université de Bretagne Occidentale (Brest)	France	6H of Lab

3. Lecture Program

Course on « MM-Wave Antenna design and Technologies» IETR- Université de Rennes 1, 19-23 May 2014				
Monday, 19th (Room GUERNESEY- Bat 12 D)	Tuesday, 20th (Room GUERNESEY- Bat 12 D)	Wednesday, 21th (Conférence room Bat 11 D)	Thursday, 22th (Thesis room- Bat 1)	Friday, 23th (Room 18- Bat 2A)
Welcome 8 :30 - 9:15		**Lab** L. Le Coq, S. Collardey, V. Laur, J-M. Floch 8:00-10:00		
Planar Antennas I A. Sharaiha 9:15-10:00	**Mm integrated antennas** L. Dussopt 9 :00-10 :00		**Materials Characterisation and Near field Imaging I** L. P. Schmidt 9:00-10:00	**Mm Antenna technologies** M. Himdi 9:00-10:00
Coffee Break				
Planar Antennas II A. Sharaiha 10 :15-12 :00	**Mm integrated antennas** L. Dussopt 10 :15-12 :00	**Lab** L. Le Coq, S. Collardey, V. Laur, J-M. Floch 10 :15-12 :15	**Materials Characterisation and Near field Imaging II** L. P. Schmidt 10 :15-12:00	**Mm Antenna technologies** M. Himdi 10 :15-11:45 **Course closing** A. Sharaiha 11 :15-12:15
Lunch				
Antenna arrays and EBG K. Mahdjoubi 13 :15- 15 :15	**Main applications** J.M. Floc'h 13 :15- 14 :15 **Metrology** L. Le Coq 14 :15- 15 :45	**Lab** L. Le Coq, S. Collardey, V. Laur, J-M. Floch 14:00-16:00	**SIW antennas, Lenses, and MEMS** R. Sauleau 13:15-16:00	
Specific mm-wave technologies C. KarnFELT 15 :15-16 :15	**Active & reconfigurable mm-wave antennas+ characterisation LaB I** O. Lafond. 15 :45-16 :15			
Coffee Break				
Specific mm-wave technologies C. KarnFELT 16 :30-18 :15	**II** O. Lafond. 16 :30-18 :00		**Reflectarrays and DRA** R. Gillard 16 :15-18 :30	
		Social Dinner 19:30		

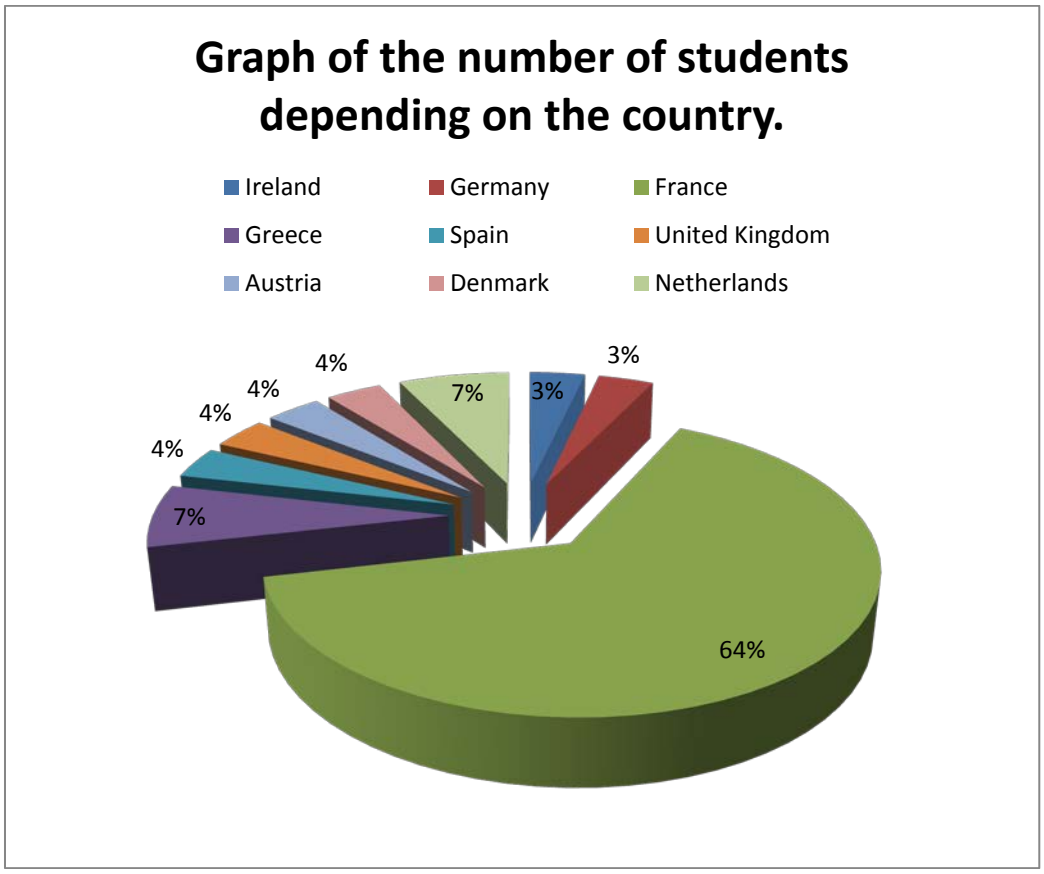
4. Participants

The list shows the students participating to the course.

N°	Student Name	University or Company	Country
1.	Ali Al-Rawi	Eindhoven University of Technology	The Netherlands
2.	Abdullah Haskou	University of Rennes 1	France
3.	Amal Harrabi	IETR Nantes	France
4.	Andre Sarker Andy**@**	Queen Mary University	England
5.	Antoine Rozé	INSA	France
6.	Arshad Mehmood	Institute of Microwave and Photonics – TU Darmstadt	Germany
7.	Bedilu Befekadu Adela	Technical University of Eindhoven	The Netherlands
8.	Carole Leduc	University of Rennes 1	France
9.	Cheikh Dieylar Diallo	University of Rennes 1	France
10.	Daouda Lamine Diedhiou	University of Rennes 1	France
11.	David Alvarez Outerelo	University of Vigo	Spain
12.	Dimitios Rongas	National Technical University of Athens	Greece
13.	Evmorfili Andreou	Institute of Informatics & Telecommunications, NCSR Demokritos	Greece
14.	Fabrizio Gentili	Technische Universitat Graz	Austria
15.	Kevin Nadaud	University of Nantes	France
16.	Laura Pometcu	University of Nantes	France
17.	Loïc Martin	University of Nantes	France
18.	Luca Di Palma	CEA, LETI, MINATEC Campus	France
19.	Massinissa Hadjiloum	University of Nantes	France
20.	Mikkel Dahl Hougs	Technical University of Denmark	Denmark
21.	Nina Lorho	University of Nantes	France
22.	Samuel Baron	University of Nantes	France
23.	Solofo Razafimahatratra**@**	UPMC-L2E	France
24.	Thomas Potelon	University of Rennes 1	France
25.	Tien-Thong Pham	Institut de physique de Rennes	France
26.	Yannick Kervran	University of Rennes 1	France
27.	Wenlong Wei	University of Rennes 1	France

There was 27 students of which:

- 10 paying; 4 grants (2 from NEWFOCUS**@**, 1 from IETR, 1 from Cost Assist)
- 17 from (University of Rennes, INSA and University of Nantes)



The group photo of the students with some of the course speakers and the co-coordinator Prof. Ala Sharaiha is shown below.

Fig 1. Photo behind IETR building at the University of Rennes 1

6. Lunches, social dinner and boat trip

Lunches for the five days were arranged in a restaurant behind the university of Rennes, located at 5 minutes walk from the course rooms.The cost of lunch was included in the course registration fee. Two coffee breaks were arranged every day. After 18:30, students were free to explore the city of Rennes.
A social dinner was organized on Wednesday 21th of May at restaurant CREPERIE SAINTE Georges, located in the city center (old part) of Rennes. The group photo of the social dinner is shown below.

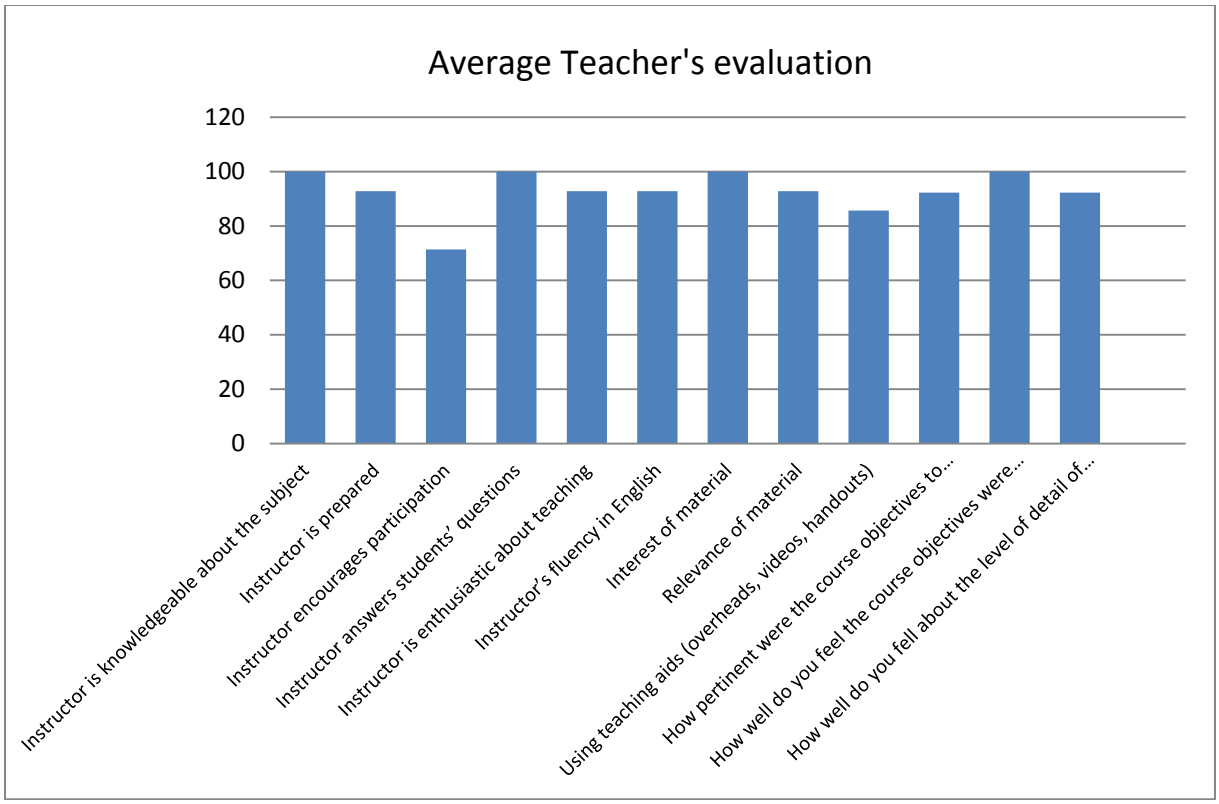
Fig 2. Social Dinner I – Creperie Saint Georges in down town Rennes

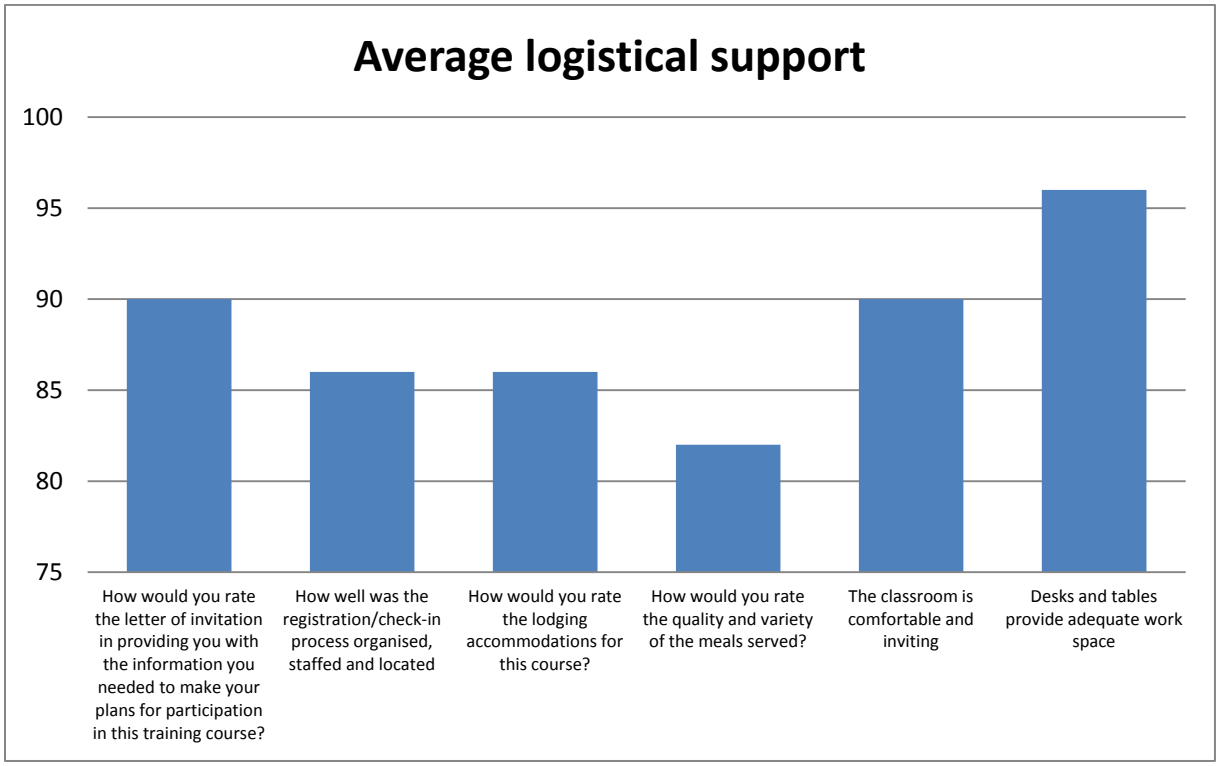
Fig 3. Social Dinner II

Fig 4. Social Dinner III

6. Courses Evaluation

The different backgrounds of the attendees lead to lively exchanges during the whole week and all gave very positive feedback about the unique set of information and know-how provided on mm-wave antenna design and Technologies.
The standard ESoA evaluation form was distributed to the students; all 27 students completed the evaluation form. After the outcome of the evaluation form and after discussion and interaction with the students, we have noticed a global satisfaction; however, some weak points have been detected, which will be useful to be considered for improving the next edition of the course.


Average Teacher's evaluation
120
100
80
60
40
20
0
Instructor is knowledgeable about the subject
Instructor is prepared
Instructor encourages participation
Instructor answers students' questions
Instructor is enthusiastic about teaching
Instructor's fluency in English
Interest of material
Relevance of material
Using teaching aids (overheads, videos, handouts)
How pertinent were the course objectives to...
How well do you feel the course objectives were...
How well do you fell about the level of detail of...


Average logistical support
100
95
90
85
80
75
How would you rate the letter of invitation in providing you with the information you needed to make your plans for participation in this training course?
How well was the registration/check-in process organised, staffed and located
How would you rate the lodging accommodations for this course?
How would you rate the quality and variety of the meals served?
The classroom is comfortable and inviting
Desks and tables provide adequate work space

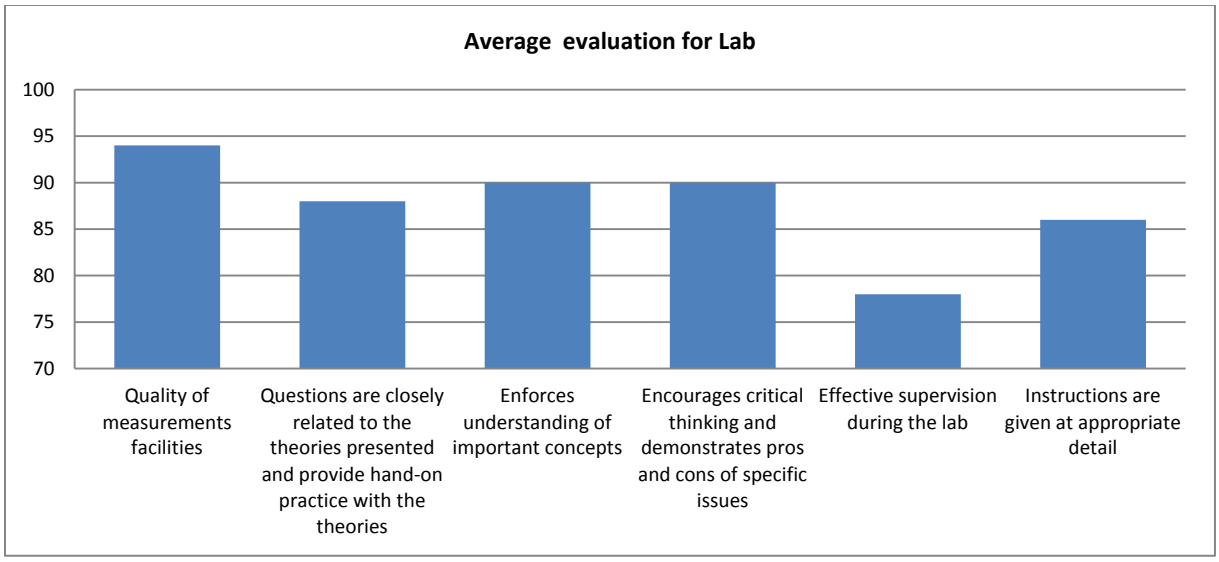


Fig 6. Course Lab-I

Fig 7. Course Lab-II

Fig 8. Course Classroom I

Fig 9. Course Classroom II

Fig 10. Course Classroom III